Ab initio Calculations of phase transition and electronic propertie of Scandium compounds

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Abstract

The structural, electronic, and elastic properties of ScN and ScP in NaCl (B1 phase) and CsCl (B2 phase) structures and the phonon dispersion. The nature of the bandgap of ScN is subject to some controversy. ScN is a semiconductor in the rocksalt (B1)
phase and a semimetal in the CsCl (B2) phase. The rocksalt (B1) configuration is found to be the most probable with the possibility of a transition to the CsCl (B2) at high pressures. One very interesting result we obtained is that ScSb, ScAs, ScP are found to be wide and direct bandgap semiconductors in the zinc blende (B3) phase. In this phase, the top of the valence band of ScN is at X but the bottom of its conduction band is at W, but this indirect X–W gap is very close to the X–X gap. It has also been found that in some cases, these materials have similar lattice constants, so that their combination could make possible the fabrication of heterostructures. However, their lattice constants are very different from that of ScN.

*Speaker

The metallicity distribution function of halo of NGC3115 galaxy : monolitic vs merger scenario.

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Abstract

Chemical evolution of the massive lenticular galaxy NGC3115 is considered. In the framework of monolithic and hierarchical merger scenaries, observed stellar metallicity distributions for the outer and intermediate halo regions of a given galaxy were simulated. It is shown that the "excess" of metal-poor stars in the metallicity distribution of the outer halo of NGC 3115 can be reproduced quite well in the framework of merger scenario. At the same time, the observational stellar metallicity distribution for the intermediate halo does not show such an "excess", therefore, this can be reproduced in a monolithic model with accretion of unenriched gas. The obtained results allows to assume that a formation of the outer halo of galaxy NGC3115 could occur by accretion of individual non-massive fragments and such fragments must be at least 4.

*Speaker

Circumstellar interaction and dust in the environment of Type IIb Supernova 1993J

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Abstract

As far as we know, large amount of dust can be produced before or during supernova (SN) explosions of massive stars. These dust grains are assumed to be responsible for observed late-time mid-infrared (mid-IR) excess of SNe. Type IIb SN 1993J is one of the most well-observed SNe in the literature with the signs of both potential dust formation processes and circumstellar interaction in its close environment; however, detailed analysis of the IR evolution of the SN is still missing.

We carried out a complete analysis of archive mid-IR Spitzer data. In order to obtain the physical properties of the ambient dust, we created spectral energy distributions (SEDs) from our mid-IR photometry and fit two-component analytic and numerical models to them. We computed the size of the assumed dust-forming region, the minimal expanding velocities, the assumed mass of the dust and the pre-explosion mass-loss rate. Our results lead us to a conclusion that a significant amount of (probably mostly pre-explosion) dust can be present in the environment of SN 1993J, in agreement with previous studies. As an additional check, we also compared our results with mass-loss rates calculated from previous published MESA models of the assumed progenitor system.

*Speaker

The global dust-corrected Halpha luminosity is always underestimated: hints from MaNGA and MUSE

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Abstract

A galaxy's Halpha luminosity is typically obtained from an optical spectrum, with a single global Balmer decrement value acting as a proxy for the dust attenuation correction. We show from analytical arguments that the global dust-corrected Halpha luminosity is always underestimated when compared to the value corrected point-by-point. For a sample of 156 high-quality galaxy observations from MaNGA at a 1-2 kpc spatial resolution, we find the global Halpha luminosity to be underestimated by 2-4%, and this effect to be systematically correlated with the specific star formation rate. From MUSE observations of NGC 628 at a 36-pc resolution, we measure the effect to be 14%. Toy models and simulations suggest those observed effects are still underestimated, thus requiring a larger sample of high resolution observations to pinpoint its true magnitude and its correlation to different galaxy properties.

*Speaker

The Oxygen Abundance of Dwarf Galaxies at Cosmic High-Noon

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Abstract

We present rest-optical MOSFIRE spectroscopy of typical star-forming dwarf galaxies at the peak of cosmic star formation through a stack of 19 gravitationally-lensed galaxies with a median z_~2.41 and log(M*/Msun) _~ 8.2. Following our study of a rare high-redshift detection of the electron-temperature-sensitive [OIII]4363 emission line in an individual galaxy in our sample (A1689-217; Gburek et al. 2019), we report a preliminary _~2.3 sigma detection of [OIII]4363 in our stack, yielding a typical electron temperature of Te([OIII]) = 15000 +/- 3000 K and a direct oxygen abundance of 12+log(O/H) = 7.9 +/- 0.2 (_~0.16 Zsolar). We find preliminary evidence that the strong-line ratios and direct metallicity of the stack are consistent with locally-calibrated, oxygen-based, strong-line ratio – direct metallicity relations, supporting the notion that such relations are reliable at high redshift for estimating metallicity. Given the stellar mass of the stack, we are also able to provide a constraint on the low-mass slope of the mass – metallicity relation at z_~2, roughly an order of magnitude lower in stellar mass than existing surveys like MOSDEF. This constraint will inform largely-unconstrained models of star formation and feedback in dwarf galaxies at z_~2.

*Speaker